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XXIX. ON MEMORIZING WITH THE INTENTION PERMANENTLY TO RETAIN

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That the intention to retain is an important factor in memorizing has been assumed from the very beginning of the experimental investigation of memory. Ebbinghaus says specifically: "During the process of learning, the purpose of reaching the desired goal as soon as possible was kept in mind as much as was feasible. Thus, to the limited degree to which conscious resolve is influential in accomplishing it, I endeavored to keep attention so far as possible concentrated on the tiresome task and its purpose."¹ This rule of Ebbinghaus has been followed with few exceptions by all later investigators. Poppelreuter remarks that *all* previous memory experiments have favored the *intentional* formation of associations. He can reproduce a series of 12 nonsense syllables after 12 repetitions; but when as experimenter he merely reads the series aloud, 50 repetitions enable him to recite only a few of the syllables.²

It has often been pointed out, moreover, that less general determinations are sometimes induced, either by instruction or by the observer's knowledge of the conditions of recall, and that these specific determinations influence greatly both the mode of learning and the adequacy of retention. Meumann,³ for example, followed every presentation of his series with a test by the method of right associates, continuing the repetitions until 100% of correct responses were given. He then asked for a reproduction of the entire series, accented and unaccented syllables alike. His observers could recall none (or only a few) of the *accented* syllables. They had depended upon the experimenter for a re-presentation of the accented syllables, and their intention in learning had been directed exclusively upon memorizing the second members of the pairs. Indeed, by tests in which the syllables were presented individually at haphazard, Meumann found that many of the accented syllables were not even recognised.

The specific determination with which we are concerned in this paper is that of learning for permanent retention as opposed to that of learning for merely temporary recall. The generally accepted belief that 'cramming' (learning merely for the present) leads to inferior retention tends to receive incidental confirmation in the results of various experimental investigations. Aall, however, first made a special study of the effect of the intention permanently to retain.⁴ A number of his experiments had a doubtful outcome, and he bases his conclusions chiefly upon mass-experiments with Norwegian school children. Even here the expected result did not appear in all cases.

¹ H. Ebbinghaus. *Ueber das Gedächtnis*, 1885, 34. For a pre-experimental reference, see W. S. Jevons, 'Cram,' *Mind*, ii., 1877, 198.

² W. Poppelreuter. *Zeitsch. f. Psych.*, 61, 1912, 3, 6.

³ E. Meumann. *Zeitsch. f. päd. Psych.*, 13, 1912, 456ff.

⁴ A. Aall. *Ber. über d. V. Kong. f. exp. Psych.*, 1912, 237ff; *Zeitsch. f. Psych.*, 66, 1913, 1ff.

Two stories, each with a decided 'point,' and two groups of familiar objects were used as material. Certain classes were told that an examination on the material would be held next day; others that the test would come after several weeks. On the second day the first class were told that something had prevented the completion of the experiment, and that the test was 'called off.' At the end of 4 or of 8 weeks both groups of classes were tested. Measured in terms of errors (falsifications and omissions), in the case of the stories the second group showed 4-13% better retention. Measured in percentage of retained objects, the second group retained 18% better in one series of experiments, and 7-9% in another (one contradictory class not counted).

Having in mind Aall's failure to find conclusive results and his neglect to study the influence of intention upon the mode of learning as well as upon retention, we have attempted a preliminary study to discover, if possible, a more reliable and more specifically analytical method. We planned not merely to measure the capacity of our observers for reproduction, after learning with the different intentions, but also to test recognition, and to study certain aspects of the processes of learning and of recall. We had in mind the expressions of Meumann and of G. E. Müller with regard to differences which might be expected in these latter regards.⁵ Meumann believes that a difference of attitude is involved in the two cases, and that an observer naturally seeks to make sensible connections in order to favor permanent retention. Müller finds that the sense-modality of learning and of reproduction may shift as a result of knowledge of the length of interval which is to elapse between learning and test.

Our experiments were made in the Psychological Laboratory of Cornell University during the Summer Session of 1915. The observers were Miss G. English (E), candidate for the Master's Degree in psychology; Miss M. Wright (W), whose training in experimental work was gained in the two elementary laboratory courses; Mr. F. L. Dimmick (D), assistant in Psychology and candidate for the doctorate; and Miss N. P. Lawson (L), whose experimental training was limited to a single laboratory course. Aside from a single practice-series, our material consisted of a Chinese-English vocabulary of 128 pairs of words arranged in 8 series of 16 pairs each. The words were typewritten in the usual English characters, and presented in the Spindler and Hoyer *Gedächtnisapparat*. The Chinese word on the right and its English equivalent to the left appeared simultaneously, and remained visible for 2.5 sec., with a blank space at the end of every revolution of the drum. The observers read aloud in trochaic rhythm for sixteen continuous repetitions. After a five-minute interval, the Chinese words were exposed in haphazard order, and the observers were required to give their English equivalents. They were in every case asked to report, if possible, the nature of the reaction. Although instructed that it might well be impossible to state in every case whether the reaction was or was not preceded by other processes than those concerned with the apprehension of the stimulus, in nearly all cases they felt able to do so. Furthermore, if imagery relevant to the recall appeared, they nearly always felt able to indicate briefly its character. The times of reaction were taken with a stop-watch; but the observers were instructed specifically that they might take

⁵ G. E. Müller. *Zeitsch. f. Psych.*, Ergbd. 5, 1911, 16ff. E. Meumann, *loc. cit.*; *The Psychology of Learning* (Trans.), 1913, 74ff.

all the time they considered advantageous for making a correct recall. Each observer at the given hour learned two series on each of four successive days; one series for temporary (T), the other for permanent (P) retention. Ten minutes elapsed between the test of one series and the learning of a second. It was explained that we were interested especially to see if the mode of learning and of recall under these two instructions was alike or different; and both P- and T-series were tested after five minutes with this comparison in view. In the T-series the observer was instructed to give fullest possible attention, and to make all possible endeavor to master the series so completely as to attain a full 100% of correct replies after five minutes. In the P-series the observer was told to learn for permanent retention; although for the sake of comparison a test would also be made after five minutes, the real test would be given about two weeks later, and this would serve to show how well the task had been accomplished. The usual warning to think as little as possible of the words between learning and recall was given.

After an interval of two weeks, at the hour of the original learning, series composed of the Chinese words from both the P- and the T-series mixed at haphazard were again presented, and the English equivalents were again required. In this test the same sort of introspective report was required as in the earlier tests; and in addition a report as to the familiarity or lack of familiarity of the stimulus-word.

E found no essential difference in her mode of learning under the two instructions. She simply adopted what she believed to be the 'natural' plan of making a sensible connection wherever possible, between the words of a pair, and of trying to anticipate the English words as soon as she had attained a certain degree of mastery of the series. Questioning after the end of the experiment brought out the fact that she had been extremely interested in the work throughout, not merely for its own sake, but also because she expected later to become a missionary worker in China. She had not interpreted the instructions to mean that permanent mastery of the T-series was forbidden.

W was disturbed by the task of learning for permanent retention. Its difficulty appeared to her very great, and she lacked self-confidence in the face of it. She felt that she did not "know how to go to work to impress the series permanently." She reports that she gives "tense attention" in learning this series, but that "attention isn't so constant and easy;" that "she can't help emphasizing some parts." In the T-series she does not "feel under so much strain," although she gives "just as much attention;" and she feels freer to try a greater number of anticipations. Here also she tries to establish more place associations, feeling that these may be advantageous after five minutes as they would not be after a much longer period.

In learning the T-series D has more regard for making definite the "feeling of saying the words of a pair together," or for "making the recitation fluent;" in the P-series he endeavors to form more meaningful connections between the words of the pairs, because he feels that he can "retain meaningful connections longer than the mere vocal-motor feel of the two words." In the T-series he pays less "attention" to the Chinese word. With greater "attention" to the English word he can risk the stimulus word touching it off, if the test is made soon. In the P-series he "distributes his attention" more equally to both members.

Even more than D, L seeks to form meaningful connections in the P-series. Like E she tries also to form place associations, especially for temporary retention, and seeks to support learning by emphasizing the rhythm of speech, by beating accents with her fingers, etc. In both series she continually seeks to anticipate in auditory and in kinaesthetic terms, the latter both vocal and graphic.

Our observers themselves, however, were impressed not so much by the differences as by the similarities of learning in the two series. The reports which we quote are selected to emphasize such differences as could be found when we looked especially for them. It is probably a mistake to require a change from one task to another within the limits of a single hour, if it is desired to give the freest opportunity for shifts of attitude and procedure. In experiments upon constrained association Watt, e. g., found that observers tend for some time to react in the sense of a just previous requirement (*Perseverationstendenz der Aufgabe*);⁶ and Müller mentions a tendency of the mode of learning to persist (*Beharrungstendenz der Lernweise*).⁷ We conceive that our failure to find constant and gross differences in the recall of the two series may possibly be due to this fact.

Table I shows the results of the tests after five minutes. The actual number of correct replies is designated by r , the number of wrong replies by w , the number of cases in which no reply was given by o . Tr , Tw , and To are averages of the corresponding reaction-times, expressed in seconds.

TABLE I

	Obs.	r	Tr	w	Tw	o	To
Temporary	E	59	3.0	1	40.0	4	38.5
	W	61	2.9	1	15.0	2	24.0
	D	52	5.0	6	8.2	6	15.5
	L	59	3.5	2	3.0	3	41.3
Permanent	E	61	2.5	1	2.0	2	42.5
	W	53	2.7	3	7.7	8	32.1
	D	47	3.4	3	16.0	14	16.3
	L	58	2.7	4	9.0	2	46.5

It is evident that 16 repetitions were sufficient to give adequate mastery of the vocabulary for such immediate recall, although no observer failed to make a few mistakes, and none of them, we feel assured, became overconfident or inattentive in the learning period. Two observers (W and D) show decidedly the advantage of the T-series over the P-series in number of correct recalls. In the case of W the advantage is to be noted especially, both because of its magnitude and because it bears out her report that the task of learning permanently was disturbing. The slight advantage of L's T-series

⁶ H. J. Watt. *Arch. f. d. ges. Psych.*, 4, 1905, 343ff.

⁷ G. E. Müller, *op. cit.*, 19ff.

and the slight disadvantage of E's are probably insignificant. The average times of the *r*-replies in the T-tests are the larger. As a possible explanation we suggest that in this test the observers may have placed greater emphasis upon giving a full 100% of correct replies; but we realize that many other factors are probably involved. The average times of the *w*- and *o*-replies are computed from so few cases that they are probably not significant. Although in the Table the average *o*-time for every observer is greater in the P-series, yet if we average the individual times for all four observers we get a higher average for the T-series (27.9 as against 25.8).

Since two of our observers were only moderately skilled in introspection, we should probably not place too great dependence upon the accuracy of their reports of the manner in which the reply-word appeared. We have made an analysis of the reports for the *r*-cases, however, and find certain tendencies which we believe to be significant. In by far the greatest number of cases in both T- and P-tests, the mere apprehension of the Chinese word (or its repetition in internal speech) seems quite immediately to touch off the appropriate response. The observers call these cases "vocal-motor reactions." This mode of recall is especially noted in the T-series, where 73% of all recalls were of this type. For the P-series the corresponding percentage is 64. The difference between the two series does not appear with E, but is evident in the cases of W (72% *vs.* 57%), D (86% *vs.* 78%), and L (68% *vs.* 47%). As between the two series, no significant differences appear in the modality of imagery, or in the frequency of occurrence before reaction of place-ideas and of ideas representing meaningful connections. As between observers, however, certain differences occur. E reports for the most part verbal and visual ideas representing sensible connections, W visual ideas representing place, D visual ideas of place (the reaction often being followed by verbal ideas representative of the sensible connections), and L chiefly auditory and kinaesthetic (graphic) ideas.

Table II shows the qualitative results of the tests after the two-weeks interval. The symbols have the same meaning as in Table I.

None of our observers realized that a second test of the T-series would be made after the two-weeks interval, although it occurred to

TABLE II

	Obs.	<i>r</i>	<i>Tr</i>	<i>w</i>	<i>Tw</i>	<i>o</i>	<i>To</i>
Temporary	E	22	9.1	2	28.5	40	42.3
	W	9	7.7	19	11.7	36	34.5
	D	18	8.1	1	3.0	45	20.3
	L	41	4.4	11	4.5	12	6.5
Permanent	E	20	18.3	5	25.8	39	46.1
	W	7	8.3	17	20.0	40	35.0
	D	21	10.3	3	7.0	40	17.9
	L	48	5.5	6	4.3	10	5.6

D at one time that such a test might possibly be required. Requiring the observers to introspect upon the mode of learning and the mode of recall, and giving them definitely the impression that we were concerned to discover possible differences between the two series, we seem effectively to have prevented the presence of any suspicion, at least during the learning. W and L indeed did not realize until fairly late in the test that words from both series were being presented.

E now makes slightly more correct recalls in the T- than in the P-series. The explanation is, first, that she did not learn the T-series *solely* for temporary retention, and her mode of learning in the two cases is much the same; and secondly that, being interested in retaining the whole vocabulary permanently for an external purpose, and taking it for granted that after the five-minute test this series was of no account experimentally, she allowed herself in the two-weeks interval to repeat a number of the associations.—Striking indeed is the small number of correct recalls made by W. Although in the test after five minutes she had shown a definitely better mastery of both series than D (51 *vs.* 47; 61 *vs.* 52), she now is able to give no more than one-third to one-half as many correct replies as that observer. Thus her report that permanent retention is hard for her to plan for, and learning for permanent retention definitely more disturbing, is again reflected in the objective results.—The *r*-replies of D show a slight advantage in favor of the P-series, and those of L a considerably greater one.

W's large number of *w*-cases also fits well with the report that in learning she was confused. The *w*-cases are also interesting from another point of view. Those of E in the T-series were neither relevant in meaning, nor did they belong to the same vocabulary-group of 16 pairs as the stimulus word; two of the five wrong replies of the P-tests were relevant. None of W's 19 *w*-replies in the T-series were relevant, and only one belonged to the appropriate vocabulary-group; whereas of 17 in the P-series, 5 were relevant and 4 belonged to the group. One of D's 3 *w*-replies in the P-series was relevant and one other belonged to the appropriate vocabulary-group; his single *w*-reply in the T-series had no relation to the learning. Of L's 11 *w*-cases in the T-series 2 were relevant and 8 belonged to their appropriate vocabulary-group; of 6 in the P-series 2 were relevant and 3 belonged to their vocabulary-group. In this connection we may mention that an analysis of the rejected replies in the *o*-cases points similarly to a greater retention in the case of the P-series. Relevant or correct words and other relevant ideas occurred, in the T-series, to E in 15%; to W in 8%; to D and W in 0% of the *o*-cases. In the P-tests, the corresponding figures are 7, 31%; W, 13%; D, 5%; L, 20%.

Of the Chinese words presented in tests of the T-series 73% were familiar to E, 63% to W, 73% to D, and 77% to L. In the P-series the corresponding figures are E 81%, W 63%, D 77%, and L 86%. The tendency, therefore, is toward greater familiarity with the words of the series learned for permanent retention, although the tendency is generally slight.

In the P-cases the average times of correct reaction, as might be expected, are longer than in the test after five minutes. The averages in the T-tests are 1.1—2 times as long as those of the P-tests, and the difference between the times of reaction after five minutes and after two weeks is much more marked in the former series (2.7 as against 1.3-3 times as long). The reports indicate very definitely a falling off in the percentage of immediate or 'vocal-motor' reactions with

the longer interval. The T- and P-series differ a little in this respect, the former still showing slightly the greater percentage, 57 as against 52%. Again we place little dependence upon the exact percentages. It seems likely to us that, in view of the length of the reaction-times, unreported sensory or imaginal processes not connected with the mere apprehension of the stimulus-word may well have occurred, and under the unfavorable conditions may have been overlooked. More frequently than in the earlier tests, the occurrence before reaction of imagery of the reply-word or of imagery referring to the learning is reported. For the most part the latter references are to the sensible connections. In only 2 cases (as opposed to 75 in the earlier test) are definite place associations reported. Of the observers L most frequently reported merely the imagery of the reply-word itself in auditory, kinaesthetic-vocal and graphic terms. D, W, and E report about equal numbers of rejected words, many more than does L. The references to sensible connections made in learning are most frequent with D and E. They are most frequently carried by visual and verbal ideas. (Cf. the relatively long times of these observers.) W and L ordinarily simply repeat the stimulus-word in inner speech, until some English word appears and is recognised and thought to be correct. L often reports a reference to the sensible connections made in learning, but most frequently these references appear as confirmations rather than as inducing factors of the reply.

As stated at the outset, we regard these experiments as useful primarily on the side of orientation in method. More reliable results would have been obtained if our observers had been given longer preliminary training in memory-work, a greater number of series, instructions of only one kind in a single hour, and the other advantages which we have mentioned. In so far as our results bear upon the problem attacked, they may be considered to show that *the intent to learn for permanent retention really brings about the desired end in the case of learning a vocabulary*. If we measure retention solely by the number of correct replies, two of our observers, to be sure, do not confirm the theory. Both cases are to be explained, however, by factors irrelevant to the question at issue; and the results of these observers should therefore be discounted, so far as the general question is concerned. Even if the correct replies of all observers are simply added together, the series learned for permanent retention total 96 to 90 in favor of the expected result, whereas after five minutes the reproductions stand in the opposite order, 219 to 231. If to this evidence we add the facts that, in the P-series, the *w*-cases are more frequently relevant in meaning or are words from the same vocabulary-group as the stimulus, that in the *o*-cases more correct or relevant replies are rejected, and that in general a slightly greater familiarity is shown, the supposition is considerably strengthened.

We find that the effect of the intention is not altogether immediate, so far as retention is concerned, but that it becomes effective in part at least through its *influence upon the mode of learning*. We have to some extent confirmed Meumann's and Müller's observations in this respect. With our material, the intention to retain permanently tends in the more objective observers to induce a greater emphasis upon the establishment of meaningful connections while learning, and in different cases to lead to (or to emphasize) other devices not so apparent in learning for merely temporary recall. These differences in mode of learning are reflected also in the nature of the recall and in the reaction-times.